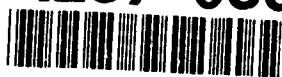


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SYSTEMATICS OF Aedes MOSQUITO PROJECT

FINAL REPORT

WAYNE N. MATHIS

MARCH 27, 1991

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<p>The Systematics of <u>Aedes</u> Mosquito Project (SAMP), a cooperative venture between the Smithsonian Institution and the U.S. Army Medical Research and Development Command, conducts biosystematic research on mosquitoes of medical importance to the Army. SAMP fulfills these objectives by performing biosystematic studies on important groups of aedine vectors of arboviruses. SAMP provides information on potential vectors for the guidance of military field research teams and other governmental agencies and prepares monographs and technical papers, which summarize data on the ecology, taxonomy and medical importance of these vectors in Africa. In addition, SAMP performs curation and research on the national collection of mosquitoes at the National Museum of Natural History, Smithsonian Institution.</p>					
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FOREWORD

Opinions, interpretations, conclusions and recommendations are those of the author and are not necessarily endorsed by the U.S. Army.

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INTRODUCTION

Biosystematic studies, which lead to the precise identification of vectors, are fundamental to any investigation of epidemiology and to the planning of control or eradication. These studies enable recognition of the vector(s); further study of the ecology and habits of the vectors; and effective diffusion of information about vectorial capacity, resistance to insecticides, geographic distribution, etc. Many instances of failure to control diseases resulting from vector-borne pathogens can be traced to neglect of this aspect of research in entomology.

The Systematics of Aedes Mosquito Project (SAMP) was developed to perform biosystematic research on medically important mosquitoes to meet the U.S. Army Medical Research and Development Command's requirements for accurate identification of actual or potential mosquito vectors of pathogens of man in Africa. Thus, SAMP is able to respond to these needs, and the resources of the project are used to accomplish these requirements. The research was accomplished by 1 professional entomologist plus the principal investigator. The work was supplemented by 4 professional entomologists from the Walter Reed Biosystematics Unit (WRBU) on assignment to the Smithsonian. In addition, upon request, SAMP assists various military and other medical entomologists in biosystematic studies of medically important mosquitoes. This level of support may range from furnishing entomologists with keys, necessary literature, and other identification guides to the loan of specialized collecting and rearing equipment, which cannot be obtained from other sources. Such support has proven invaluable to all concerned, as the Smithsonian Institution has received extremely worthwhile material from these entomologists.

1. Biosystematic studies of Aedes

A major portion of this period was devoted to the examination of specimens of African Stegomyia. 1,709 specimens, including 493 male and female genitalia, were studied in detail. Other tasks included dissecting genitalia, making slide preparations, identifying specimens, resolving taxonomic problems, preparing descriptions and illustrations and writing manuscripts for publication.

During this period, three manuscripts were completed and published. Studies were concentrated on the simpsoni, africanus and luteocephalus species complexes of the simpsoni and africanus groups, each of which contains several species that are important vectors of various arboviruses of man. A monograph on the africanus group was completed and published in 1990. African species of stegomyia have been implicated as natural hosts, vectors, and/or reservoirs of 8 viruses, 6 of which cause human illness (Chikungunya, dengue 1 and 2, Dugbe, Rift Valley Fever, yellow fever and Zika). Chikungunya, dengue and yellow fever are the most important arboviruses associated with Stegomyia. Despite their medical importance, published records on African Stegomyia are superficial and inadequate, and it is extremely difficult to accurately identify specimens of vector species for mosquito survey, virus isolation studies and epidemiological studies.

This paper is part of a revision of the subgenus Stegomyia Theobald (genus Aedes Meigen) from the Afrotropical Region. Aedes (Stegomyia) africanus (Theobald) has been recognized as one of the most important virus vectors in the Afrotropical Region [as Ethiopian Region] (Haddow, 1961). The africanus group contains several species that are important vectors of arbovirus to humans in Africa. A thorough study to determine the diversity of species that occur in the area and to develop adequate and reliable methods for recognizing them became evident and has led to this taxonomic revision.

Due to the complexity and highly variable nature of the group, this study has been hindered by the lack of individually reared, associated specimens from East and Central Africa.

In this paper, the africanus group of the subgenus Stegomyia Theobald, genus Aedes Meigen, is characterized. Diagnostic characters for separating the africanus group from other Stegomyia are given. Eight species of Stegomyia, of which 1 species is new, are recognized in the africanus group. The known stages of the 8 species of the africanus group are described or redescribed and illustrated. Keys to the identification of the species (Males and Females, Male Genitalia, Pupae, and Fourth Stage Larvae) are provided. Information on the present status of the africanus group and its distribution are summarized. Information on type data, distribution, bionomics, medical importance and a taxonomic discussion of each species are presented.

List of Publications Arising During This Period

- (1) Huang, Y.-M. 1988a. Aedes (Stegomyia) joshiahae, a new species of the simpsoni subgroup (Diptera: Culicidae). Proc. Entomol. Soc. Wash., 90 (2):155-163. illus.
- (2) Huang, Y.-M. 1988b. Aedes (Stegomyia) pseudonigeria group with emphasis on the species from the Afrotropical Region (Diptera: Culicidae). Mosq. Syst., 20(1): 1-20. illus.
- (3) Huang, Y.-M. 1990. The subgenus Stegomyia of Aedes in the Afrotropical Region. I. - The africanus group of species (Diptera: Culicidae). Cont. Am. Entomol. Inst. (Gainesville). 26(1): 1-90.

2. Curatorial Activities

The mosquito curation project involved the amalgamation of three mosquito collections. The "Southeast Asian" collection was originally separated from the Smithsonian collection in 1964 and then greatly expanded during the sixties and seventies by the U.S. Army and field trips by the Southeast Asia Mosquito Project, Medical Entomology Project and SAMP workers. The "World" collection was what remained of the original Smithsonian collection. This collection was partly curated during the seventies with very few specimens added. The third collection was that of the late Dr. John Belkin. The core of this collection is the specimens that Dr. Belkin collected during World War II. Later collections made by Dr. Belkin and various UCLA graduate students under grants from NIH and the US Army, increased the size of this collection

many fold. The combined pinned and slide-mounted mosquito collection at the Smithsonian is now in excess of 1,000,000 specimens.

The pinned adults were inventoried by species and drawer using RBASE 5000. A master list of the locations of all specimens of all species was prepared. From this list, technicians, each working on a different genus, gathered together all specimens of a species. The specimens were then arranged by country, either chronologically or by collection number, whichever was most appropriate. In this manner 1117 drawers of six genera (Aedes, Anopheles, Coquillettidia, Culex, Limatus and Orthopodomyia) were curated.

In a like manner, the approximately 5000 slide boxes were inventoried in preparation for eventual amalgamation and curation.

3. Other Activities

(1) Identifications were made of 106 Aedes (Aedimorphus, Christophersomyia, Diceromyia, Finlaya, Mucidus, Neomelaniconion, Rhinoskusea, Verrallina, and Stegomyia) and 1 Culex (Culex) mosquitoes from India, Kenya, Nepal, Pakistan, Pitcairn Island, Puerto Rico, and Sulawesi for Dr. R. Reuben, Centre for Research in Medical Entomology, India; Mr. E. L. Peyton, WRBU; Dr. R.F. Darsie, Jr. The International Center for Public Health Research, College of Health, University of South Carolina; CAPT L. Lance Sholdt, Dept. of Preventive Medicine/Biometrics, Uniformed Services University of the Health Sciences (USUHS); Dr. Wayne N. Mathis, Department of Entomology, Smithsonian Institution; Dr. R.A. Ward, WRBU; Professor R. Kitching, Department of Ecosystem Management, University of New England, Armidale, NSW 2352, Australia.

(2) Assistance was given to Dr. R. Reuben, Director, Centre for Research in Medical Entomology (Indian Council for Medical Research), India, on (a) the identification and confirmation of Aedes mosquitoes from India that were identified by her staff, (b) on the nomenclature of the pupal chaetotaxy and the anomalous setae of mosquitoes, and (c) reviewed and wrote comments, suggestions and corrections on 1 manuscript written by her staff.

(3) Five manuscripts were critically reviewed and annotated for the Journal of the American Mosquito Control Association; Mosquito Systematics; and Proceedings of the Entomological Society of Washington.

Appendix 1: LIST OF SAMP CONSULTANTS

Dr. Michael Cornet, Institut Pasteur de Dakar (ORSTOM), B.P. 220, Dakar,
Republique de Senegal. African Aedes

Dr. Max Germain, ORSTOM, Head, 70-74 route d'Aulnay, 93140 Bondy, France.
African Aedes

MAJ Ralph E. Harbach, Ph.D., Walter Reed Biosystematics Unit, MSC, Smithsonian
Institution, Washington, D.C. 20560. Culex of Southwest Asia

LTC Bruce A. Harrison, Ph.D., U.S. Army Medical Research Unit, Department of
State, Washington, D.C. 20520. Old World Anopheles and Southeast Asian
mosquitoes

Dr. J. Mouchet, ORSTOM, Department of Entomology, Bondy, France. Culicidae

COL John F. Reinert, Ph.D., Office of the Surgeon General, HQDA (DASG-PSP),
5109 Leesburg Pike, Falls Church, VA 22041-3258. Aedes subgenera

Dr. Ronald A. Ward, Walter Reed Biosystematics Unit, MSC, Smithsonian
Institution, Washington, D.C. 20560. New World mosquitoes